

Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.



Research Note

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

U. S. DEPT. OF AGRICULTURE

INTERMOUNTAIN FOREST & RANGE EXPERIMENT STATION AGRICULTURAL LIBRARY
OGDEN UTAH

MAY - 8 1967

U.S. Forest Service
Research Note INT-52

CURRENT SERIAL RECORDS
1966

DEVELOPMENT OF PONDEROSA PINE PROGENY IN WESTERN MONTANA

Raymond C. Shearer¹

ABSTRACT

Ponderosa pine seed production was determined after controlled pollination of four trees and natural pollination of three others. Following 2 years of growth in a nursery, the 1-1 progeny were outplanted in western and eastern Montana. Ten years later, all the trees planted in eastern Montana were dead because of drought. Seedlings from all sources but one outplanted in western Montana survived well. Most of these seedlings grew at comparable rates; chief exceptions were those grown from seed of self-pollinated cones picked near the planting site and seed taken from wind-pollinated cones from eastern Montana.

Geographic source of seed frequently and importantly affects the success of plantations, even within the natural range of the species. One challenge that faces the tree breeder is to identify crosses that will produce trees with hybrid vigor. This study helped identify some crosses that initially survived well and showed good growth characteristics.

PROCEDURE

In 1953, four ponderosa pine (*Pinus ponderosa* Laws.) trees growing on the Lubrecht Experimental Forest² in western Montana were selected as seed parents for controlled pollinations.³ The age, diameter at breast height, and total height of each tree are summarized as follows:

¹ Associate Silviculturist, headquartered at Intermountain Forest and Range Exp. Station's Forestry Sciences Laboratory, Missoula, Montana, which is maintained in cooperation with the University of Montana.

² Maintained by the University of Montana, School of Forestry, Missoula, Montana.

³ Study was started, flowers were pollinated, and seed was collected by Anthony E. Squillace, Research Forester, formerly assigned to Intermountain Forest and Range Exp. Station and now assigned to Southeastern Forest Exp. Station. Seedlings were outplanted by David Tackle, Research Forester, formerly assigned to the Intermountain Forest and Range Exp. Station and now assigned to the Pacific Northwest Forest and Range Exp. Station.

<u>Tree number</u>	<u>Age</u> (Years)	<u>D.b.h.</u> (Inches)	<u>Total height</u> (Feet)
PP1	108	19.5	92
PP2	153	19.0	81
PP3	146	15.0	73
PP4	¹ 164+	18.3	68

¹Heart rot prevented determination of age.

Trees PP1, PP2, and PP4 were selected on the basis of accessibility, fruiting ability, and ease in climbing. Tree PP1 had good growth rate and crown form. Tree PP3 showed superior phenotypic traits, phenomenal growth response to release, and excellent crown form. However, the tree bore few flowers and was not used for hybridization trials. Instead, its few flowers were pollinated from tree PP1 to try to cross two superior phenotypes. Table 1 lists all the crosses attempted.

Flowers were bagged on May 19, 1953, pollinated June 11 to 20, and cones collected September 7, 1954. Metal bands prevented squirrels from climbing the trees. The extracted seeds were winnowed by hand to remove most of the empty seed.

Seed produced in 1954 from these controlled pollinations, together with several lots from wind pollinations, were sown in the Montana State Nursery at Missoula in 1955. During the period May 4-10, 1956, the 1-0 stock was transplanted. The 1-1 seedlings were outplanted May 2, 1957, on the Custer National Forest, and on May 7 and 8, 1957, on the Lubrecht Experimental Forest. Both areas formerly grew ponderosa pine. The study was installed in a randomized block design with three replications at each location. Six trees of each lot were planted in each block. The trees were spaced 6 feet apart.

RESULTS

Seed yield. -- Table 1 summarizes the crosses and their resulting seed yields. The crosses that produced best seed yield were: (1) three local ponderosa pine (P. ponderosa) seed parents and "eastside" ponderosa pine (P. ponderosa var. scopulorum) pollen parents from the Custer National Forest; (2) an intraspecies cross between trees PP1 and PP3; and (3) the self-pollination of PP1.

Seed from wind-pollinated cones was available from tree PP2 only. This was surprising because at the time of pollination, trees PP1 and PP4 had numerous flowers that were not used in controlled pollination.

Outplanting survival and development. -- Survival was a contrast of extremes between the two study areas. In 1965, 8 years after outplanting on the Lubrecht Experimental Forest, all progenies except PP1 X PP1 had high survival (table 2). Conversely, on the Custer National Forest all trees died by 1962 because of drought; this prevented any comparisons of the progenies by planting site.

The 1965 remeasurement on the Lubrecht Experimental Forest revealed that all seedlings except those from PP1 X PP1 and PP1 X PS (Custer) had similar development (table 2). Figure 1 contrasts the best seedling from PP1 X PP1 (poorest average development) with the best seedling from PP1 X PS (Custer) (best average development). The P. ponderosa X P. ponderosa var. scopulorum hybrids generally had the best development. Because these trees are just beginning maximum growth, any real differences in height, diameter, or crown width will become apparent in future measurements.

Table 1. --Summary of pollination data and seed collections

Seed parent	Pollen parent	Source of pollen	Flowers pollinated	Cones collected	Total sound seed	Sound seeds per conc	Average seed weight	Abbreviated lot designations
							Mg.	
				-Number-		Av.		
P. ponderosa #1	P. ponderosa #1	--	15	14	284	20.3	50.2	PP1 X PP1
P. ponderosa #1	P. ponderosa v. scopulorum	¹ PREF	14	12	±964	80.3	56.2	PP1 X PS(Custer PR)
P. ponderosa #1	P. ponderosa v. scopulorum	² Ashland, Mont.	20	15	±922	61.5	53.8	PP1 X PS(Custer)
P. ponderosa #2	Wind	--	--	20	563	28.2	43.4	PP2 X wind
P. ponderosa #3	P. ponderosa #1	--	13	8	498	62.2	38.3	PP3 X PP1
P. ponderosa #4	P. ponderosa v. scopulorum	³ Ashland, Mont.	17	13	±1,326	102.0	35.2	PP4 X PS(Custer)
P. ponderosa ⁴	Wind	--	--	44	±2,515	57.2	42.6	PP(LEF) X wind
P. ponderosa ₂ v. scopulorum	Wind	--	--	14	640	45.7	38.1	PS(Custer) X wind
P. ponderosa v. scopulorum ⁵	Wind	--	--	16	404	25.2	52.7	PS(Custer PR) X wind

¹ Pollen collected from two trees growing on the Priest River Experimental Forest. The trees are located in racial variation test established in 1911. Their source is Camp Cook, Custer National Forest, elevation 3,100 feet.

² A mixture collected on the Fort Howes District, Custer National Forest, elevation 3,800 feet.

³ Pollen collected from three trees growing on the Fort Howes District, Custer National Forest (from the same stand that the mixture indicated in footnote 2 was collected).

⁴ A three-tree mix of seed collected on the Lubrecht Experimental Forest.

⁵ A two-tree mix collected on the Priest River Experimental Forest (from the same plot indicated in footnote 1).

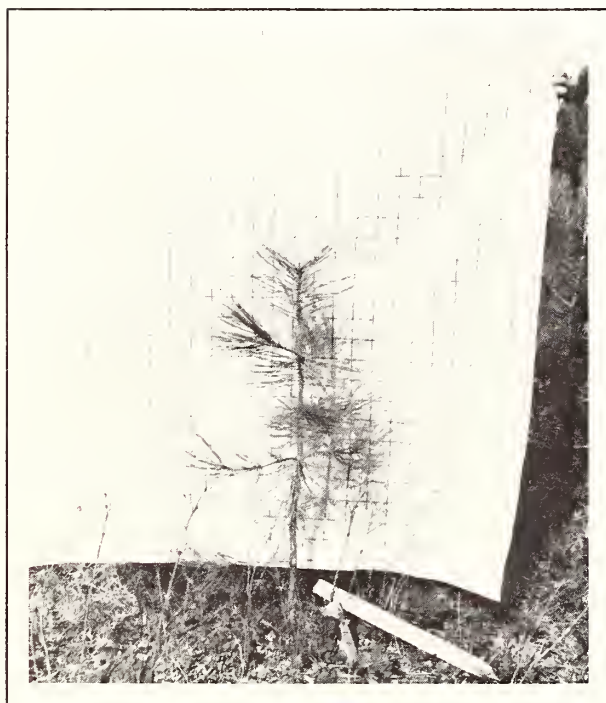
Table 2. --Survival and means of height, diameter, and crown width in 1965 of ponderosa pine hybrids planted on the Lubrecht Experimental Forest in 1957

Hybrids of <i>P. ponderosa</i> ¹	Survival	Height	D.o.b. ²	Crown width
	Percent	Feet	Inches	Feet
PP1 X PP1	33	³ 1.76	0.48	1.03
PS (Custer) X wind	94	2.00	0.74	1.22
PP3 X PP1	72	2.97	0.86	1.84
PP(LEF) X wind	89	3.40	1.08	1.99
PP1 X PS (Custer PR)	89	3.53	1.08	2.16
PP2 X wind	100	3.66	1.12	2.23
PP1 X PS (Custer)	100	3.69	1.18	2.29
PP4 X PS (Custer)	94	3.41	1.05	2.38
PS (Custer PR) X wind	94	3.44	1.18	2.42

¹ See table 1 for description of seed and pollen parents.

² Diameter outside bark at ground line.

³ Means enclosed by any single bracket are not significantly different at the 5-percent level.



A



B

Figure 1. --Comparisons of the best 10-year-old seedlings: (A) PP1 X PP1; (B) PP1 X PS (Custer). Each square is 2 X 2 inches.